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On a Quest for Safer Skies: Managing the Growing Threat of Wildlife Hazards to Aviation

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MANAGING THE GROWING THREAT OF WILDLIFE HAZARDS TO AVIATION

By Gail Keirn, Jonathon Cepek, Brad Blackwell, Ph.D., and Travis DeVault, Ph.D.

Courtesy of Gail Keirn

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The images remain indelible: On a chilly January day in 2009, a U.S. Airways Airbus A320 departed from New York's LaGuardia Airport. About five miles out, flying at 2,900 feet, it collided with a flock of Canada geese (*Branta canadensis*), severely damaging the plane's engines. Within minutes of the collision the pilot safely conducted an emergency landing on the Hudson River. All 155 passengers survived.

The incident crystallized the dangers birds can pose to aviation—sometimes with deadly consequence. In September 1995, for example, an E-3 Sentry AWACS aircraft took off from Alaska's Elmendorf Air Force Base. Immediately after takeoff its port side engines ingested several Canada geese. The aircraft crashed into woods about two miles northeast of the runway, killing all 24 crew members aboard.

Bird and other wildlife collisions with aircraft, called wildlife strikes, have jumped significantly over the past two decades. According to a joint report by the U.S. Department of Agriculture (USDA) and the Federal Aviation Administration (FAA), there were 1,759 reported bird strikes in 1990; in 2008 there were 7,516 reported strikes (FAA 2009)—an increase by greater than a factor of four. From 1988 to February 2009, at least 229 people died and 210 aircraft were destroyed as a result of bird strikes with civil and military aircraft (Richardson and West 2000; Thorpe 2003, 2005; Dolbeer, unpublished data). In addition, between 1990 and 2008, wildlife strikes—approximately 97 percent involving birds—cost the civil aviation industry in the U.S. about $614 million per year (Dolbeer *et al.* 2009). Worldwide, bird strikes occurring between 1990 and 2000 cost commercial air carriers over $1.2 billion a year (Allan and Orosz 2001).

Credit: Adam Samu

An ominous cloud of European starlings (*Sturnus vulgaris*) engulfs a British Airways Boeing jet as it attempts to land at the Budapest-Ferihegy International Airport in Hungary. Over the last two decades, wildlife strikes with aircraft have jumped significantly.

The magnitude of the issue has placed it at the forefront of public and policy discussions—and squarely in the lap of the USDA's Wildlife Services (WS) program, a part of the Animal and Plant Health Inspection Service (APHIS).

Wildlife Air Traffic Control

The mission of the WS program is to provide federal leadership in managing conflicts with wildlife. Its legal authority is rooted in the 1931 National Animal Damage Control Act (7 USC 426-426c), which authorizes necessary, safe, and effective wildlife damage management efforts. WS program staff provides expertise to protect public and private resources threatened by wildlife conflicts such as predation on livestock, property destruction, disease transmission, and aviation strikes.

According to the WS 2010-2014 Strategic Plan, the program's aviation mission is explicit: "Expand efforts to enhance public safety by providing timely and appropriate science-based assistance to the aviation community in preventing, investigating, monitoring, and reducing/eliminating wildlife hazards to meet the demand for safe air operations of the air transportation industry, Department of Defense, and the traveling public."

That's a tall order, and it's keeping WS staff busy. Over the last 20 years, as levels of wildlife hazards have grown, WS biologists have witnessed a steady increase in the number of civil and military airports requesting assistance to manage wildlife hazards. Program assistance jumped from 42 airports in 1990 to a record

822 airports in 2009, both in the country and abroad (Begier and Dolbeer 2010, in press).

The spike in wildlife strikes has several causes, including the boost in civil aviation air traffic, larger airframes, and replacement of piston-powered engines with turbine power (Blackwell et al. 2009a). Researchers also note increases in the populations of some larger wildlife species that present substantial hazards to aviation safety, including Canada geese, American white pelicans (*Pelecanus erythrorhynchos*), sandhill cranes (*Grus canadensis*), and bald eagles (*Haliaeetus leucocephalus*) (Dolbeer and Eschenfelder 2003).

With so many birds, planes, and people flying, it's difficult to assess risk in the air. One invaluable tool that helps with the task is the WS-managed FAA Wildlife Strike Database, which provides valuable information on wildlife strikes such as the species involved, time of day, season, and flight altitude. "This information helps determine our research and management priorities," says Michael Begier, national coordinator for the WS Airport Wildlife Hazards Program. Since the database began in 1990, it has recorded more than 108,000 civil and military wildlife strikes.

To avoid strikes, the U.S. Code of Federal Regulations requires "Part 139-certified airports"—airports that service aircraft with more than 30 seats—to conduct formal Wildlife Hazard Assessments (WHAs) and develop Wildlife Hazard Management Plans if their aircraft carriers experience "triggering events" such as a wildlife strike or even the potential of one. Some Part 139-certified airports (there are more than 560 in the U.S.) may also be required to employ biologists certified in airport wildlife hazard management to assess hazards, provide training, and help develop, implement, and evaluate hazard management plans. With only one wildlife biologist on staff, the FAA often relies on the WS program for professional expertise.

On-The-Ground Tactics

Airport biologists face numerous challenges associated with managing wildlife on airport grounds. They must be vigilant and creative in their attempts to disperse animals habituated to management techniques, while being sensitive to airport security issues. In addition, biologists often work under legal mechanisms and constraints required by the FAA, the Department of Defense, and the general public. "While most biologists work to increase animal populations or create wildlife habitat, I focus on making airports and areas surrounding airports less attractive to wildlife," says Randy Outward, a WS airport biologist in Cleveland, Ohio. "It's a case of reverse engineering."

Credit: National Transportation Safety Board

USDA Wildlife Services airport biologists Michael Begier (left) and Allen Gosser collect bird remains from the engine of the U.S. Airways jet from ill-fated Flight 1549—the plane that collided with a flock of Canada geese at 2,900 feet forcing the pilot to make an emergency landing in New York's Hudson River.

Though hazard-reduction tactics can vary depending on the wildlife and locations involved, airport biologists have a number of basic tools they can integrate and adapt to do their jobs. Among them:

Non-lethal dispersal. The most commonly used non-lethal dispersal method is harassment with pyrotechnics, including screamer-sirens, bird-bangers, shell crackers, and CAPA devices, which can travel 1,000 feet before creating a loud explosion. Propane exploders can be relocated and the timing of their firing can be changed so that animals don't become habituated. Wildlife may also disperse when frightened by visual devices such as bird effigies and Mylar flagging—ribbons made from reflective Mylar material that's believed to trigger a neophobic response in wildlife. Although such visual devices can temporarily deter wildlife, they're most effective when combined with other techniques and used before wildlife become established in an area.

Habitat modification. To make areas on and around airports less desirable to wildlife, biologists will often plant unpalatable grasses, remove vegetation used as roosts or shelter, and install fences or nets to prevent access. At Cleveland's Hopkins International Airport, biologists are replacing seed mixtures that wildlife like to eat with less-preferred varieties such as the endophyte-infected tall fescue. WS is also working with the airport to extend the base of its perimeter fence to prevent coyotes and other mammals from burrowing under it.

Capture and translocation. After acquiring U.S. Fish and Wildlife Service permits, WS biologists can

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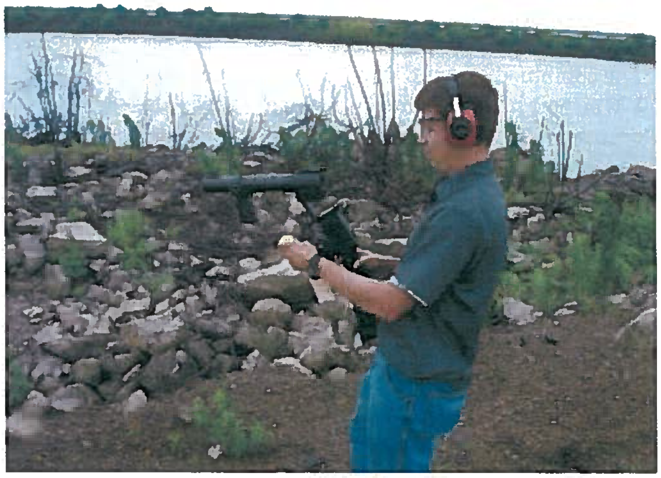

Credit: USDA Wildlife Services

Wildlife Services airport biologist Randy Outward (above) field tests a new pyrotechnics launcher, used to harass problem birds near airports. Outward describes his work as "reverse engineering"—devising methods to make airport environments less desirable to wildlife. Wildlife Services airport biologist Rebecca Mihalco (below) carefully removes a red-tailed hawk from a live trap at the Cleveland Hopkins International Airport. The bird was banded and relocated.

Credit: USDA Wildlife Services

use specialized non-lethal traps to capture, band, and relocate raptors. Between 2003 and 2009 WS used non-lethal traps to relocate 149 raptors from Cleveland's airports.

Lethal control. When wildlife species become habituated to harassment methods, biologists may implement an integrated approach, combining non-lethal tools with lethal measures such as shooting, trapping, and euthanasia. Five months after the "miracle on the Hudson" WS officials captured and euthanized more than 2,500 Canada geese found within five miles of New York City's two major airports—La Guardia and John F. Kennedy. Lethal removal serves not only to address immediate strike hazards, but also to enhance the effect of pyrotechnics by associating a negative consequence with auditory harassment.

Integrated Wildlife Damage Management. The integration of several techniques, both lethal and nonlethal, used in an Integrated Wildlife Damage Management Program, has been especially successful at two Cleveland airports. In 2003, WS entered into a Cooperative Service Agreement with the City of Cleveland to supplement the airport's existing wildlife management activities and help reduce wildlife hazards at Burke Lakefront Airport. WS used visual and sound harassment, exclusion, gull effigies, pyrotechnics, propane exploders, and lethal reinforcement to make the adjacent lakefront area less attractive to resident and migrating birds, especially gulls. Shooting was sometimes implemented to remove persistent birds and reinforce harassment techniques. WS also collaborated with the U.S. Army Corps of Engineers to combine standard wildlife techniques with modified dredging activities near the airport to reduce bird use of these areas. This integrated approach reduced gull activity near the airport by over 52 percent in the first year of the project.

Also in 2003, WS began working with Cleveland Hopkins International Airport to address a safety hazard involving European starlings (*Sturnus vulgaris*) that were roosting by the thousands in a canopy area at the airport, causing a hazard to aircraft as the birds flew back and forth across runways from the roost site to feeding sites. To dissuade the birds from roosting, WS biologists used several techniques, including habitat management and harassment with sound. Starlings were harassed from the airfield with distress calls, compressed air, and pyrotechnics, and removed by shooting and trapping. WS biologists also discouraged roosting by thinning, pruning, and removing trees near the canopy. In 2008 WS worked with airport officials to install netting to prevent bird access to the canopy. By 2009, the number of starlings in the area had fallen from 16,000 to 3,000 individuals.

The Science of Hazard Management

Wildlife biologists on the ground rely on science-based strategies. Much of that applied science comes from WS' National Wildlife Research Center (NWRC), where researchers develop biologically sound, environmentally safe, and socially responsible solutions to wildlife damage-management problems. In recent years, NWRC field station personnel based in Sandusky, Ohio, have worked on the following issues fundamental to reducing wildlife hazards to aviation:

Species-habitat relationships. There has been no consensus regarding the species composition and height of grass that best reduces wildlife hazards (Blackwell *et al.* 2009a). Indeed, researchers studying the relationship between blackbird preferences for short versus tall vegetation in north-central Ohio found no difference in use (Seamans *et al.* 2007). Under semi-natural conditions with captive birds, however, researchers found that tall fescue may reduce foraging by Canada geese (Washburn *et al.* 2007).

Bird movement patterns. Biologists quantify bird movements in relation to airport locations and aircraft flight patterns to better understand wildlife strike risks. Researchers studying neck-collared Canada geese near John F. Kennedy International Airport in New York found that individual birds remained within five kilometers of their original marking location more than 90 percent of the time. In addition, 78 percent of locations used by the marked geese were within eight kilometers of the airport (Seamans *et al.* 2009). This indicates that site-specific management of Canada geese within eight kilometers of the airport will likely reduce the risk of goose strikes.

Lighting systems. NWRC scientists, along with university and private partners, are collaborating to learn more about how birds detect and respond to approaching objects. Studies show that vehicle lighting (varied by pulse frequency) can be used to enhance birds' abilities to detect and avoid approaching ground-based vehicles (Blackwell *et al.* 2009b) and aircraft (Blackwell *et al.* unpublished data). Researchers also found that the response of a species to an approaching vehicle depends not only on its visual capacity but also on its response to predation. So, for example, brown-headed cowbirds (*Molothrus ater*)—with a reduced ability to visually track an object—were especially alert to an approaching vehicle under specific vehicle-lighting treatment, which according to researchers might also cause them to flush earlier, likely to reduce the risk of predation (Blackwell *et al.* 2009b). In contrast, mourning doves (*Zenaida macroura*)—with wider fields of vision and an ability to detect more-distant objects—maintained position, possibly relying on cover for safety.

Stormwater management. NWRC scientists work with WS biologists to guide airports on the design and location of stormwater-management facilities, which can attract waterfowl and other bird species hazardous to aviation. Researchers suggest that stormwater ponds be located as far away as possible from other water resources, but recommend a minimum of one kilometer of separation between a planned stormwater facility and other water resources (Blackwell *et al.* 2008).

The combined efforts of NWRC's researchers and WS airport biologists often culminate with collaborative field studies at airports across the country. Over the years NWRC research efforts on vegetation management, non-lethal deterrents, repellents, and enhancement of perceived risk to birds have contributed to the success of WS in reducing wildlife strike rates at civil airports (Dolbeer unpublished data) and airbases in the U.S. and abroad. This practical application of research not only directly reduces wildlife hazards, but also produces valuable data for future research and airport management. "The research findings coming out of NWRC help make my job easier," says Randy Outward. "Thanks to their work, I know I'll always have the latest scientific tools and techniques for reducing wildlife hazards at airports." That work will become even more essential as more people and planes take to the skies.

This article has been reviewed by subject-matter experts.

For a complete bibliography go to *www.wildlife.org*.